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ABSTRACT

This study focuses on the effectiveness of "Solutions Unlimited," a computer software program developed to teach problem solving to middle level students. Fifty-one fourth, fifth, and sixth graders (21 girls and 30 boys) attending a private school in a small mid-west community were the subjects for this experiment; none had received prior training in problem solving. For a pretest, all students completed the Purdue Elementary Problem Solving Inventory (PEPSI), subscales of which include such things as sensing that a problem exists, judging information, analyzing details, solving problems, and verifying solutions. Subjects in the treatment group then worked in groups of three on one lesson of "Solutions Unlimited" each week for eight weeks. The control group participated in a creative dramatics group during the same period, and was given an opportunity to use the computer software following the study. Results of the study did not indicate any significance in the difference scores of the treatment group; both groups generally achieved similar change scores. There is speculation that the design of the PEPSI was not appropriate for the age group involved, and also that problem solving may need to be integrated into the entire curriculum rather than being taught for 45 minutes once a week. The strength of the computer program used is in its simulations, which create realistic life situations. It is suggested that follow-up activities should be used to stimulate the possibility of transfer of problem-solving skills learned from the computer simulations to new and novel situations. (7 references) (CGD)

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The Effectiveness of a CBI Program for Teaching Problem Solving Skills to Middle Level Students

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The Effectiveness of a CBI Program on Problem Solving Abilities of Middle Grade Students

Problem Solving

Problem solving is a complex set of interdisciplinary skills and abilities that education has identified as a critical instructional topic. It has been identified as a subset of critical thinking that uses creative, conceptual, and thinking skills in unfamiliar situations (Feldhusen & Treffinger, 1977; Hoelscher, 1984). Educators have long been seeking methods of teaching problem solving skills to their students (Bransford, Stein, Declos, & Littlefield, 1986). There are several models for teaching these skills in the literature along with a myriad of materials available on the market.

The process approach is recommended by many authors, including Polya, Beyer, and Bransford and Stein. All of these authors advocate a series of steps that can be learned and applied to any new situation. Some suggest teaching problem solving within a specific content area and teach for transfer to other situations, others suggest using real-life problems to solve to aid in the learning of the process.

Computer

There has been a recent proliferation of materials available for the microcomputer that claim to teach problem solving skills. Why consider th computer for teaching problem solving? There are several possibilities for suggesting the computer as a teaching tool. First, it can present real-life problems that would be difficult or impossible without the computer. For example, the computer can collapse time so that students can see the results of their decisions promptly. The computer can also present situations that would other-wise be dangerous for students. Students can make decisions and see

the results without fear of consequences. The computer allows for programs to be written to branch and send students in different directions depending on the decisions made.

There is, however, a lack of empirical evidence validating the use of computer as an instructional tool in teaching problem solving strategies to middle level students.

Purpose

The study described in this paper attempts to evaluate the effectiveness of one of those computer software programs developed to teach problem solving. Solutions Unlimited, a public domain software package, was selected because it was designed to be a comprehensive program for developing problem solving abilities in middle level students and its attempt to teach general problem solving strategies. The program follows a pattern of problem solving skills similar to those recommended by Polya (1957). There are eight units in the package, the first being a tutorial teaching the four step process for problem solving, "Hey Wait," "Think," "See," "So." The seven subsequent units are situational lessons that give the students opportunities to apply those steps. Use of real-life problems help students to realize that solutions are not always clear and that more than one solution may often be applied to the same problem. The lessons cover topics such as considering alternatives, judging sources of information, and drawing conclusions.

Investigation

Fifty-one middle level students attending a private school in a small community in the Mid-West were the subjects for this study. The students were enrolled in fourth, fifth, and sixth grades. There were twenty-one girls and thirty boys involved. None had received any prior training in problem

solving. The students were randomly assigned to either a treatment group or control group.

All of the students completed the Purdue Elementary Problem Solving Inventory (PEPSI), developed by J.Feldhusen, as a pretest. The PEPSI uses a filmstrip and audio tape with paper/pencil response sheets. The PEPSI is designed to measure several skills appropriate to problem solving. The subscales on the PEPSI include such things as sensing that a problem exists, judging information, analyzing details, solving problems, and verifying solutions.

A computer lab setting of five computers was used for the experimental group instruction. The experimental group students were assigned to one of two instructional groups that met for forty-five minutes each. During the class period, the students in the treatment group were divided into computer work triads, small groups of three students each. The students worked on one lesson each week for eight weeks, starting with Unit 1, introducing them to the Solutions Unlimited materials. The teacher followed the directions accompanying the computer software to insure consistency within the experimental groups. The control group participated in a creative dramatics class during the same eight weeks. They were given an opportunity to use the computer software following the study.

At the end of the eight weeks all of the students completed the PEPSI again as a posttest. The difference score for each student was calculated. T-tests were used to determine the significance of the difference between the pretest and posttest scores.

Results

The results of the study did not indicate any significance in the difference scores of the treatment group. The students in both groups generally achieved similar change scores.

These results indicated that while the Solutions Unlimited program was specifically designed to teach problem-solving skills, the students participating in the instruction did little better in the posttest than did the students who had not received the direct instruction. There is speculation that the design of the PEPSI, used for measuring the change in scores, was not appropriate for the age group involved. The answer sheets should have been changed to discourage possible cheating and to appear less primary.

The program was well received by the students participating and they looked forward to the computer sessions. It may well be that problem solving cannot be taught for forty-five minutes once a week, but needs to be integrated into the entire curriculum. The strength of the computer program used is in its simulations that create realistic life situations. Students need to recognize that the skills used in that single situation can be applied in other similar settings. The suggestion, then, is to employ techniques for transfer of skills learned in the computer simulations to new and novel situations.

The literature suggests that problem solving and critical thinking skills cannot be developed in a short period of time, but rather may take several years to develop. We may be placing too high an expectation level on the students when we look for change after only a short period of time for training. This is one common problem with many of the research studies done in computer applications.

Further research using more age appropriate forms of the test and using the supplementary materials to teach for transfer is necessary. There is some provision for follow-up activities within the materials used in this study to stimulate the possibility of transfer of newly learned problem-solving skills to other situations. The present study did not allow sufficient time to complete any of those follow-up activities. A follow-up study is being designed that will investigate the

possible change in scores when teaching for transfer has been added to the instruction.

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